PHY-116 Waves and Optics

Credit Hours: 2-1

Pre-requisites: None

Course Objectives: It is undergraduate core course and aims to make students understand Simple harmonic oscillator and its applications. Interference, reflection, refraction, and diffraction phenomena. Geometrical optics and wave properties of light.

Course Contents: Simple harmonic motion, superposition principle, spring-mass systems and pendulums, forced oscillators, damped oscillators, power in driven oscillators, Huygens' principle, Doppler effect, interference, diffraction, One-dimensional wave equation.

Detailed Course Contents: Introduction to simple harmonic motion, Mass-spring system, Simple pendulum, Energy of the SHO, Damped harmonic oscillations, Forced damped harmonic oscillations and Resonance, Propagation of a disturbance, The travelling wave model, The speed of waves, Reflection and transmission, Rate of energy transfer by sinusoidal waves on strings, the Linear wave equation, Sound waves, speed and intensity of sound waves, Doppler's effect, Huygen's principle, Dispersion, Total internal reflection, Optical Fiber, Image formed by flat and spherical mirrors/ Lenses, Lens Aberrations, The simple magnifier, The Compound Microscope, Telescope, Conditions for interference, Young's double slit experiment, Intensity distribution of the interference pattern, Interference in thin films, Newton's rings, The Michelson's interferometer, Diffraction patterns and polarization, Intensity of single slit diffraction patterns, The diffraction gratings and its applications, Intensity of double slit diffraction patterns, The diffraction gratings and its applications, Polarization of light waves, Methods for polarization of light

Course Outcomes:

At the end of the course, students will be able to

- Acquire knowledge of waves for several physical phenomena.
- Apply the knowledge of wave concept to other fields of physics.
- Understand the mathematical aspects of waves and optics

Text Books:

- Physics for Scientists and Engineers with Modern Physics, Seventh Edition, Raymond A. Serway and John W. Jewett, Jr. (SJ)
- Vibrations and Waves by A. P. French, W. W. Norton & Company 1971
- Oscillations and Waves: An Introduction by Richard Fitzpatrick, CRC press 2013

Weekly Breakdown		
Week	**Section**	**Topics**
1	Ch. 15 (SJ)	Introduction to simple harmonic motion, Mass-spring system, Simple pendulum, Energy of the SHO
2	Ch. 15 (SJ)	Damped harmonic oscillations, Forced damped harmonic oscillations and Resonance.
3	Ch. 16 (SJ)	Propagation of a disturbance, The travelling wave model, The speed of waves, Reflection and transmission
4	Ch. 16 (SJ)	Rate of energy transfer by sinusoidal waves on strings, the Linear wave equation
5	Ch.17 (SJ)	Sound waves, speed and intensity of sound waves, Doppler's effect
6	Ch. 35 (SJ)	Huygen's principle, Dispersion, Total internal reflection, Optical Fiber
7	Ch.36 (SJ)	Image formed by flat and spherical mirrors/ Lenses, Lens Aberrations
8	Ch.36 (SJ)	The simple magnifier, The Compound Microscope, Telescope
9	Ch. 37 (SJ)	Conditions for interference, Young's double slit experiment,
10	Ch. 37 (SJ)	Intensity distribution of the interference pattern, Interference in thin films

11	Ch. 38 (SJ)	Newton’s rings, The Michelson’s interferometer
12	Ch. 38 (SJ)	Diffraction patterns and polarization, Intensity of single slit diffraction patterns
13	Ch. 38 (SJ)	The diffraction gratings and its applications
14	Ch. 38 (SJ)	Intensity of double slit diffraction patterns
15	Ch. 38 (SJ)	The diffraction gratings and its applications
16	Ch-38. (SJ)	Polarization of light waves, Methods for polarization of light
17	Final Exam	